REMARKS

Applicant respectfully requests reconsideration of this application as amended. Claims 1-29 remain in the application. Claims 1 and 12 have been amended. No claims have been canceled. Claims 21-29 have been added.

Title

Responsive to the objection in the Office Action regarding the title of the application, Applicant amended the title to "Vector Quantization with a Non-Structured Codebook for Audio Compression."

Abstract

As Examiner requested, Applicant amended the abstract by deleting the first sentence.

Priority Claim

Applicant thanks the Examiner for noting that there may be an issue with the priority claim in that it originally used the term "continuation" with regard to a provisional application, which is incorrect. The Applicant on 4/30/2004 through a preliminary amendment changed the priority claim language of the application from "This is a continuation of . . ." to read "This application claims the benefit of . . . ." Applicant respectfully submits that the nonprovisional application 09/649,143 filed on 08/25/2000 correctly claims priority under 35 U.S.C. § 119(e) to provisional application 60/157,647 filed on 10/04/1999 as recognized by the Office on the filing receipt for the 09/649,143 application. If Applicant is in error, Applicant respectfully requests clarification.

New Claims

To put claims 2, 5, 14, and 18 in the form the Examiner indicated would be allowable, Applicant added claim 21 to rewrite dependent claim 2 with all the limitations of claim 1, claim 22 to rewrite dependent claim 5 with all the limitations of claim 3, claim 25 to rewrite claim 14 with all the limitations of claim 12, and claim 28 to rewrite dependent claim 18 with all the limitations of claim 16.

Applicant added dependent claims 23, 24, 26, 27, and 29. Applicant rewrote claims 4 and 6 as claims 23 and 24 respectively to be dependent on claim 22. Likewise, Applicant added new claims 26 and 27 as rewrites of claims 13 and 15 respectively to be dependent on claim 25. Dependent on claim 28, Applicant added claim 29 as a rewrite of claim 17. Applicant respectfully submits that the dependant claims 23, 24, 26, 27, and 29 are allowable for at least the reason that they are dependent on the new independent claims Examiner indicated would be allowable.

Rejections under 35 U.S.C. § 112

Claim 1

To address the statement of the Office Action regarding the "non-structured codebook" of claim 1, Applicant amended claim 1 to specifically recite what Applicant believes was already inherent in the claim. Applicant amended claim 1 to read "a searching unit including a non-structured codebook, said searching unit having an input to receive a source vector and an output to provide a reduced version of a non-structured codebook."

Regarding the "first quantizer," the Office Action is correct in presuming that the "first quantizer" produces a useful output. However, the claim elements are distinguished from the prior art, at least, by the inputs in the "first quantizer" as described in more detail below.

Claim 3

To address the statement in the Office Action regarding the "non-structured codebook" in claim 3, Applicant respectfully submits that claim 3 particularly points out and distinctly claims the Applicant's apparatus for audio compression as required by 35 U.S.C § 112. In claim 3, " a storage unit having stored therein a non-structured codebook" is coupled to a codebook constructor. The claim further requires "a codebook constructor coupled to said first quantizing unit" and " having an output to provide a reduced version of said non-structured codebook." A second quantizing unit is also coupled to the codebook constructor.

Regarding the "second quantizer," the Office Action is correct in presuming that the "second quantizer" produces a useful output. However, it should be understood that the claim elements are distinguished from the prior art, at least, by the inputs in the "second quantizer" as described in more detail below.

Claim 7

Applicant respectfully submits "predicted codewords" are known in the art to be codewords that are based on previous quantized versions of an input. Standard codewords are known in the art to be codewords that are not based on previous quantized versions of an input. Generation of predicted codewords is also known in the prior art. In the prior art example, shown in Figure 1 of the specification, one previously quantized source vector is stored in buffer 150. (Specification page 2, ll. 12-13, See Figure 1 of Specification). This value is then introduced to a predictor unit 160 that computes some predetermined number of source vector predicted values. (Specification page 2, ll. 13-14, See Figure 1 of Specification).

Rejections under 35 U.S.C. § 103(a)

Applicant's claims 1, 3, 4, 6-13, 15-17, 19 and 20 have been rejected under 103(a) as being unpatentable over the hierarchical vector quantizer described in Vector Quantization and Signal Compression by Allen Gersho and Robert M. Gray ("Gersho") in view of the tree-searched, multi-stage codebook described in "Efficient Search and Design Procedures for Robust

Multi-Stage VQ of LPC Parameters for 4 kb/s Speech Coding" by W.P. LeBlanc et al. ("LeBlanc").

Claims 1 and 8

Applicant's claims 1 and 8 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the hierarchical vector quantizer of Gersho in view of the tree-searched, multi-stage codebook of LeBlanc.

Applicant respectfully submits that the hierarchical vector quantization of Gersho combined with the tree-searched, multi-stage codebook method of LeBlanc would not teach or describe the Applicant's independent claims. The Applicant understands the combination as disclosing a quantization system that first extracts from the supervector a new vector referred to as the feature vector before the first quantization stage. (Gersho pages 461-462 and page 464, Figure 12.25). Quantization of the feature vector is preformed using a quantizer coupled to tree-searched codebooks cascaded in a multi-stage configuration. Applicant finds no indication in the references cited that the codebooks are formed based on the same supervector or feature vector. Next, the quantized feature vector is used to form a reduced version of the supervector (this is not a codebook). (Gersho page 462 and page 464, Figure 12.25). The reduced version of the subvector is then partitioned into subvectors. (Gersho 462 and page 464, Figure 12.25). Each subvector has a feature vector extracted and then each corresponding feature vector is quantized individually by a quantizer coupled to tree-searched codebooks cascaded in a multi-stage configuration. (Gersho page 462, LeBlanc page 373). Applicant does not find any indication in the references cited that these codebooks are created based on the supervector, feature vector or subvector being quantized. Finally, the overall process is repeated for K stages until the indices, output from each quantizer stage, with the lowest distortion are chosen and summed. (LeBlanc pages 373 and 375).

Thus, one quantizer of the combination has as its inputs the output from a tree-searched, multi-stage codebook (which is not selected based on the source vector) and feature vectors of

the subvectors (generated by processing the supervector and the output of the first quantizer by a reduction unit, then partitioning the output of the reduction unit to generate subvectors, and the feature extraction of those subvectors). This is not what Applicant claims.

Applicant's claim 1 requires the "first quantizer . . . to receive said source vector" and the "reduced version of the non-structured codebook," where this reduced version of the non-structured codebook is the output of the "searching unit" whose input includes the same "source vector." Thus, the same source vector used by the searching unit to produce the reduced version of the non-structured codebook is used by the first quantizer to quantize that same source vector. Put another way, a reduced version of a non-structured codebook, calculated based on a source vector, is the codebook used to quantize the same source vector.

In the audio compression method of claim 8, Applicant requires "selecting from a non-structured codebook a subset of codewords to form a reduced complexity codebook based on said source vector." Claim 8 also requires "quantizing said source vector with said reduced complexity codebook." Therefore, a reduced complexity codebook is formed based on the same source vector that is quantized using that reduced complexity codebook.

The above quoted limitations are not described or suggested by the combination. While there are various uses for the invention as claimed, at least one or more exemplary uses are discussed in the paragraphs on page 9 beginning on line 7 through page 10, line 9 of the specification. Thus, while the invention is not limited to the uses discussed in these paragraphs, it should be understood that the combination of Gersho and LeBlanc does not enable these uses.

For at least these reasons, Applicant respectfully submits that the independent claims are allowable. The Applicant respectfully submits that the dependant claims are allowable for at least the reason that they are dependent on an allowable independent claim.

Claims 3, 12, and 16

As discussed above, the combination of Gersho and LeBlanc teaches hierarchical vector quantization with the output of a tree-searched, multi-stage codebook and a feature vector

extracted from the supervector as inputs to a first quantization stage. The quantized feature vector is then used to form a reduction of the supervector. This reduced vector is then partitioned into subvectors. Once partitioned, a feature vector is extracted from each subvector and then each feature vector is quantized using a quantizer coupled to a tree-searched, multi-stage codebook not based on the supervector. This process is repeated for K stages and the indices with the lowest distortion are chosen and summed. This is not what Applicant claims in claims 3, 12, and 16.

The apparatus for audio compression of claim 3 requires "a first quantizing unit having an input to receive a source vector and having an output to identify different ones of a plurality of representative codewords based on said source vector." The apparatus also includes "a storage unit" with "representative codewords based on said source vector" are mapped to a set of codewords in a non-structured codebook stored within. The apparatus further requires "a second quantizing unit . . . having an input to receive said source vector" and "coupled to said codebook constructor" that provides "a reduced version of said non-structured codebook." Thus, the first quantizer uses the source vector to produce representative codewords that are used to create a non-structure codebook used by the second quantizer to quantize that same source vector.

The audio compression method of claim 12 includes the requirement of "searching a first stage non-structured codebook for a predetermined number of codewords based on a source vector." Also required in claim 12 is "constructing a non-structured codebook from a union of said plurality of sets of codewords." These "plurality of sets of codewords . . . corresponding to a different codeword in said first stage non-structured codebook" are "based on a source vector." The method further includes the requirement of "quantizing a source vector with said non-structured codebook." Therefore, the same source vector quantized with the non-structured codebook is the source vector the predetermined number of codewords were based on that were used to form the non-structured codebook.

The method of audio compression of claim 16 requires "selecting from a first stage codebook a list of codewords closest to a source vector." Another requirement of claim 16

includes "using said list of codewords" closest to a source vector "to select a plurality of sets of codewords." Claim 16 further requires "creating a reduced codebook from the union of said plurality of sets of codewords." Also, claim 16 requires "selecting from said reduced codebook a codeword closest to said source vector." Thus, the same source vector used to select a list of codewords, which is used to create a reduced codebook, is the source vector used to select from the reduced codebook a codeword closest to that same source vector.

The above quoted limitations are not described or suggested by the combination. While there are various uses for the invention as claimed, one or more exemplary uses are discussed in paragraphs on page 10 beginning on line 10 through page 11, line 12 of the specification. Thus, while the invention is not limited to the uses discussed in these paragraphs, it should be understood that the combination of Gersho and LeBlanc does not enable these uses.

For at least these reasons, Applicant respectfully submits that the independent claims are allowable. Applicant respectfully submits that the dependant claims are allowable for at least the reason that they are dependent on an allowable independent claim.

Claims 7 and 19

As discussed above, the combination of Gersho and LeBlanc teaches hierarchical vector quantization with the output of a tree-searched, multi-stage codebook and a feature vector extracted from the supervector as inputs to a first quantization stage. The quantized feature vector is then used to form a reduction of the supervector. This reduced vector is then partitioned into subvectors. Once partitioned, a feature vector is extracted from each subvector and then each feature vector is quantized using a tree-searched, multi-stage codebook not based on the supervector. This process is then repeated for K stages and the indices with the lowest distortion are chosen and summed. This is not what Applicant claims in claims 7 and 19.

In claim 7, the apparatus for audio compression includes the requirement of "a first stage quantizer . . . having an input to receive a source vector." The output of the first quantizer generates "a list of error vectors based on said candidates and said source vector". Another

requirement of claim 7 is "a quantizer coupled to said plurality of" multistage vector list quantizers and "having an input to receive said source vector and an output to generate an index from said list of indices of a best candidate." The multistage vector list quantizers "having an output to generate a plurality of quantized subvectors" from a "subset of error vectors" based on said candidate and said source vector. Thus, the same source vector used by the first quantizer to generate a list of error vectors is used by another quantizer to select the best candidate from the quantized versions of the error vectors based on that same source vector.

Claim 7 further requires a logic unit coupled "to said first stage quantizer and having an output to transmit" subsets of error vectors. One subset "corresponding to one of said predicted codewords" and another subset "corresponding to one of said standard codewords." The apparatus also employs splitting units "coupled to said logic unit and having an output to generate a plurality of subvectors." Claim 7 also requires "a plurality of multistage vector list quantizers (MSLQ)" coupled to the splitting units.

Lastly, the method of audio compression of claim 19 includes the requirement of "quantizing a source vector" and "selecting a list of smallest error vectors based on said quantizing." Another requirement of claim 19 includes "selecting a best candidate based on said multiple quantized subvectors and said source vector." "The multiple quantized subvectors" are created from the "list of smallest error vectors" based on the quantized source vector. Therefore, the same source vector quantized to select a list of error vectors is used to select a best candidate from the multiple quantized subvectors created from the list of smallest error vectors based on that quantized source vector.

Further requirements of claim 19 include "selecting a list of smallest error vectors based on said quantizing and a list of indices for codewords corresponding to the error vectors on said list." The method also requires "splitting an error vector from said list of smallest error vectors into multiple subvectors" with a first or second splitting unit if the list of indices corresponds to either a set of predicted codewords or a set of standard codewords.

The above quoted limitations are not described or suggested by the combination. While there are various uses for the invention as claimed, at least such uses are discussed in the paragraphs page 15 beginning on line 17 through page 17, line 4 of the specification. Thus, while the invention is not limited to the uses discussed in these paragraphs, it should be understood that the combination of Gersho and LeBlanc does not enable these uses.

For at least these reasons, Applicant respectfully submits that the independent claims are allowable. Applicant respectfully submits that the dependant claims are allowable for at least the reason that they are dependent on an allowable independent claim.

Conclusion

Applicant respectfully submits that the rejections have been overcome by the remarks and that the claims are in an allowable form. Accordingly, Applicant respectfully requests the rejections be withdrawn and the claims be allowed.

Invitation for a telephone interview

The Examiner is invited to call the undersigned at 408-720-8300 if there remains any issue with allowance of this case.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

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